

REPORT 009

WATER:

An Action Plan for reducing water usage on construction sites

June 2011

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A contribution to delivering the targets in the joint government and industry Strategy for Sustainable Construction



Material change for a better environment



Carbon Emission Reduction Target

Planned Approach to Training

Climate Change Bill
Code for Sustainable Homes

CONSTRUCTION

WATER: An Action Plan for reducing water usage on construction sites

This report is part of series of outputs aimed at supporting the delivery of the targets within the Strategy for Sustainable Construction, a joint industry and government strategy published in June 2008. www.bis.gov.uk/policies/business-sectors/construction/sustainable-construction

The project was commissioned by the Strategic Forum for Construction (SFfC) and prepared by the Strategic Forum Water Subgroup: www.strategicforum.org.uk

Funding support for the project was provided by the Department for Business, Innovation and Skills (BIS), the Department for Food and Rural Affairs (DEFRA) and WRAP.

WRAP (Waste & Resources Action Programme) is backed by government funding and aims to help business and individuals to reap the benefit of reducing waste, develop sustainable products and use resources in an efficient way. www.wrap.org.uk

The chief researcher for the report was Carmen Waylen of WRc plc. www.wrcplc.co.uk

The report was structured and edited by Jane Thornback, Coordinator of the Strategic Forum for Construction's Sustainable Construction Task Group and also sustainability Advisor at the Construction Products Association

The UK Contractors Group (UKCG) provided extensive input to the project.



The "Delivering the Strategy Targets" series was initiated by Jane Thornback of the Construction Products Association. The Association is the umbrella body for construction product manufacturers and merchants.

www.constructionproducts.org.uk

EXECUTIVE SUMMARY

This Action Plan has been developed to assist the construction industry in reducing the volume of water used on construction sites. The Plan identifies a set of actions that the construction sector will need to take if improvements are to be achieved.

The Action Plan is a contribution to delivering a water target within the joint government and industry Strategy for Sustainable Construction launched in July 2008. This Plan addresses the target of:

“By 2012, water usage in the manufacturing and construction phase to be reduced by 20% compared to 2008 usage”.

Relatively little work has been carried out to date on water sustainability on construction sites. Water use is considered a relatively low priority in comparison to the focus on reducing waste and improving the carbon footprint. However, as water moves up the political and environmental agenda due to increasing pressure on water resources across the UK, it is anticipated that this will change.

The Action Plan has been developed by the industry for the industry and has benefited from valuable input and direction from the Strategic Forum for Construction Water Subgroup. The group is made up of key representatives from the construction and manufacturing industries who are in a position to take forward and lead work to reduce water consumption, as well as government officials and representatives from the regulatory agencies such as the Environment Agency. The Water Subgroup has been supported in its work by an expert secretariat provided by WRc plc. Funding for the research support has been provided by the government's Department for Business, Innovation and Skills from 2008-09, the Department for the Environment, Food and Rural Affairs (Defra) from 2009-10, and currently WRAP (2010-11).

The programme of work has resulted in:

- An agreed methodology for measuring water usage
- The declaration of a 2008 baseline using the agreed methodology
- Identification of the major water using processes and thence priorities for reduction activities.

This information has then been used to develop this Action Plan which, if successfully implemented, will enable the construction industry to meet the water use target.

The Strategic Forum for Construction Water Subgroup has calculated the baseline water consumption on construction sites for 2008 against which progress can be measured. The agreed value is 148m³ per £million contractors output at constant price in 2008. This Action Plan contains details of this baseline and information on how it was derived. Progress towards the Sustainable Construction Strategy target will now be measured against this baseline consumption.

The Action Plan highlights two major themes. Firstly, the need to gather information on where water is used, and where water is wasted on construction sites, along with the identification of suitable water conservation measures. Secondly, the Action Plan aims to improve site water use behaviour through embedding principles of water conservation throughout the construction process.

The collection of further data on water using processes on sites and the identification of where water is wasted are the first steps on the Action Plan as there is very limited knowledge on this subject. The Strategic Forum for Construction Water Subgroup have developed a number of tools, including data collection pro-forma and an audit methodology, which will enable and support the data gathering exercise.

The Water Action Plan is one of a series of plans aimed at improving the sustainability performance of construction. Others include an action plan for reducing carbon emissions, a plan to halve construction waste to landfill, and a process to increase the uptake of responsibly sourced products.

This Action Plan for reducing water consumption on construction sites will be taken forward by the Strategic Forum for Construction Water Subgroup which will promote its implementation throughout the industry.

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I. Introduction

I.1 This Action Plan identifies a set of activities aimed at reducing water usage on construction sites. It has two main themes, to:

- Identify water use on construction site by process/activity
- Improve site water use behaviour, processes and technologies.

Each major theme has a set of actions associated with it. Lead organisation(s) for each step are suggested along with a timescale for completion.

I.2 Water usage in the UK is increasing and at the same time parts of the UK, such as the South-east, are becoming drier. Potential future climate change and a predicted substantial rise in population numbers will only exacerbate the demand for water. Strategies for better management of water are therefore beginning to emerge in all sectors.

I.3 Within construction, the joint government and industry Strategy for Sustainable Construction¹ published in 2008, highlighted the issue of water use by construction activities and included a number of targets pertaining to the more efficient use of water. One such target identified water usage on construction sites as a priority area. The target, identified by the industry itself, is that:

“By 2012, water use in the manufacturing and construction phase to be reduced by 20% compared to 2008 usage”

This Action Plan addresses this target and identifies the necessary actions to achieve it.

I.4 The body responsible for delivering the water target is the Strategic Forum for Construction (SFfC) and this Action Plan has been developed by the SFfC's Water Subgroup. The Subgroup comprises key representatives from the construction industry especially from the UK Contractors Group (UKCG) as well as manufacturing who are in a position to take forward and lead work to meet the target, as well as Government officials and representatives from the regulatory agencies. The Water Subgroup has been supported in its work by research from an expert secretariat provided by WRc Plc. Funding support for the Secretariat has been provided by the government's Department of Business, Innovation and Skills from 2008-09, Defra (2009-10) and currently WRAP (2010-11).

I.5 Relatively little work has been carried out to date on water sustainability on construction sites. Water use is considered a relatively low priority in comparison to the focus on reducing waste and improving the carbon footprint. However, as water moves up the political and environmental agenda it is expected that this will change.

I.6 Current knowledge of where water is used on construction sites and the volumes involved is limited. The collection of additional data and identification of where water is wasted are the first steps identified in the Action Plan. To facilitate this process, the SFfC Water Subgroup has developed a number of tools including data collection pro-forma and an audit methodology; further information on these can be found in the annexes to this Action Plan.

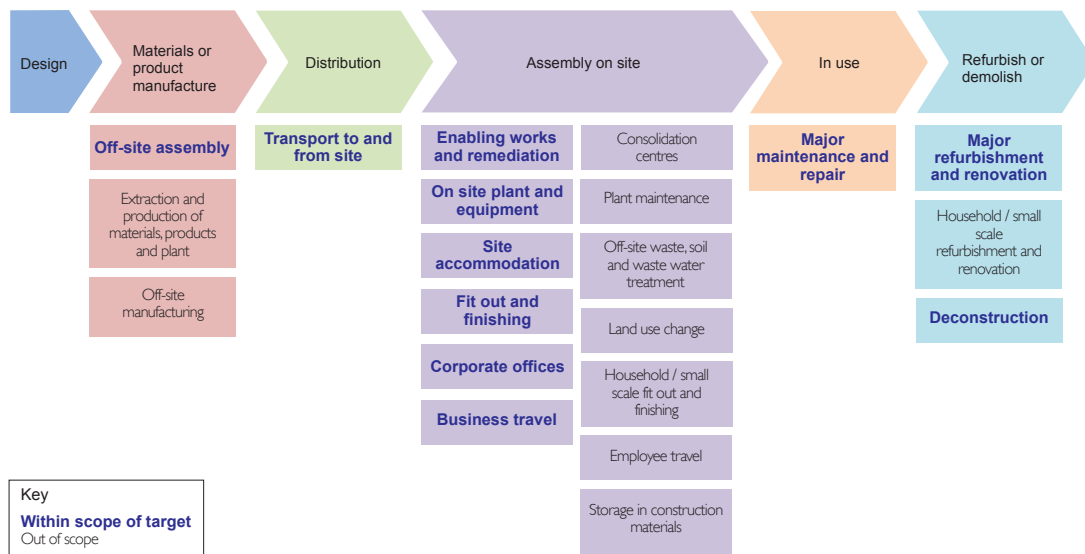
1. BERR (2008) Strategy for sustainable construction.

- 1.7 Until such time as better water audit data is available, the Strategic Forum for Construction's Water Subgroup has calculated a baseline water consumption on construction sites for 2008 against which progress can be measured. Details of the methodology used and the agreed baseline are contained in Section Six of the Action Plan and in Annexe B. Progress against this target will be assessed in the future.
- 1.8 The Strategic Forum for Construction is pursuing similar work streams on targets relating to carbon, waste, responsible sourcing and biodiversity. There are some commonalities between the work streams including the units by which baselines are declared, and elements of construction life-cycle that are included and excluded from consideration.

2. Scope

- 2.1 This Action Plan is about water usage on construction sites. The scope of the Plan is shown in Figure 1 below.

Figure 1: Scope of Action Plan



- 2.2 The Action Plan is intended to be a 'living' document, which will require updating as new activities and information becomes available.

3. How the Action Plan was developed

- 3.1 The body responsible for delivering the water target is the Strategic Forum for Construction (SFfC). In early 2009, the SFfC obtained funding from the government's Department for Business, Innovation and Skills (at that time called Business, Enterprise and Regulatory Reform) to carry out a short scoping study to review what information existed on water use in construction and manufacturing to enable the Strategy target to be measured and monitored.
- 3.2 The scoping study was undertaken on behalf of the SFfC by the specialist water research consultancy WRc plc and the findings were presented to a workshop of industry and government representatives in late February 2009.
- 3.3 Subsequently, a Strategic Forum Water Subgroup was established comprising representatives from industry (including contractors and manufacturers) and government departments and agencies. The Subgroup took forward work to expand the scoping study and to develop this Action Plan. The Subgroup is supported by an expert Secretariat provided by WRc plc which was funded by a grant from the government's Department for Environment, Food and Rural affairs (Defra) between 2009 and 2010, and by a grant from WRAP (Waste and Resources Action Programme) from October 2010 onwards.
- 3.4 The Strategic Forum Water Subgroup works very closely with the UK Contractors Group (UKCG), a member organisation of the Strategic Forum for Construction.

List of Contributors to the Action Plan

- 3.5 The following people have given generously of their time to contribute to the development of this Action Plan.

Name	Company
Gareth Brown	Bovis Lend Lease
Jonathan Garrett	Balfour Beatty
Virginia Hall	Defra
Jade Hunt	Vinci Construction
Steven Jones	Defra
Juan Martinez	Kilby Gayford
Jane Thornback	Strategic Forum for Construction & Construction Products Association
Juliette Willems	Environment Agency
Carmen Waylen	WRc Plc
Jim Wiltshire	WRAP

4. Water usage on construction sites

- 4.1 A prerequisite for understanding how to reduce water usage on construction sites is to have a clear understanding of where water is used, how much is used, where water is being wasted, and what behaviours and/or technologies can be introduced to successfully reduce water wastage.
- 4.2 The UK Contractors Group (UKCG), a member organisation of the Strategic Forum for Construction, greatly facilitated this understanding by developing a matrix of water using processes and best practices relating to these processes (see matrix in Annexe A).
- 4.3 Key water using processes on construction sites are considered to be:
- Site cabins and temporary accommodation
 - General site activities including tool washing
 - Wet trades, such as brickwork, screeding, concreting and plastering
 - Groundworks, including grouting and drilling
 - Dust suppression, including road and wheel washing
 - Hydro-demolition
 - Cleaning of tools and plant equipment, lorry washing
 - Commissioning and testing of building plant and services

5. Where water is wasted on construction sites

- 5.1 The first and immediate priority for reducing water use on construction sites is to eliminate water wastage. However, there is currently very limited information on the proportion of construction site water used for different activities and processes. Following discussions with contractors and construction site employees, a number of activities have been identified where it is thought the majority of water wastage occurs. These are:
- General dust suppression, suppression on site roads and wheel washes
 - Hydro-demolition with high pressure water
 - Lorry wash out
 - Wash out of ready mixed concrete wagons
 - Site and general cleaning
 - Specialist and high pressure cleaning
 - Commissioning plant and services

6. Methodology for measuring water usage on construction sites, and the 2008 baseline

6.1 Extensive research into data sources and methodologies for calculating a 2008 baseline for the Strategy for Sustainable Construction target was carried out. Full details of the sources consulted, variability in reported values and calculations undertaken to derive the baseline are described in Annexe B.

6.2 In line with other work streams of the Strategic Forum for Construction on carbon and on waste, the water usage baseline is calculated on the basis of £million contractors output at constant prices, taken from the Construction Statistics Annual 2009². These values are calculated for 2008 as:

- England £94,619 million
- Wales £4,13 million
- Scotland £9,545 million

6.3 A limited number of contractors have measured water consumption on construction sites for a number of years and it was possible to obtain estimates of water use on sites from five large companies. The lowest value reported was 112m³ per £million contractors output.

6.4 Because of the variability in construction site water use volumes, national datasets were sought that would verify the information and provide a top down assessment. There are two main types of water used on construction sites for which data was sought:

- Directly abstracted water
- Mains water consumption

6.5 A value for directly abstracted water use was derived from a 2007 Envirowise study, in conjunction with further information provided by the Environment Agency.

The overall volume of directly abstracted water thought to be used on construction sites in 2008 is 1.3m³ per £million contractors output at constant price.

6.6 A value for mains water use was derived from ONS Environmental Accounts and analysis by the Environment Agency.

These two data sources suggested an average mains water consumption on sites of approximately 147.1m³ per £million contractors output at constant price.

2. Available for download at www.statistics.gov.uk/StatBase/Product.asp?vlnk=284 accessed 16th February 2010. Note, calculation to obtain 'constant price' for each of England, Wales and Scotland has been carried out and verified by Nobel Francis, the Construction product Association economist.

- 6.7 Combining the estimates of directly abstracted water and mains water consumption, the Strategic Forum Water Subgroup agreed to declare the 2008 baseline for the Strategy target as:

148m³ water per £million contractors output at constant price

This baseline includes all elements of water consumption associated with contractor's site activity.

- 6.8 There is not currently adequate information to provide baseline assessments for different types of construction projects e.g. buildings, civils etc. However it is anticipated that in the future this will be possible once better data is available directly from contractor's records of water consumption on sites.
- 6.9 To aid future data collection, a project pro-forma for data collection has been devised (Annexe C) that allows data on construction and project type, value of the project and duration of the project to be collected on a monthly basis. The UK Contractors Group (UKCG) has suggested that this data should be collected for all projects over £300,000 value and as best practice for projects of lower value. It is anticipated that publication of the pro-forma will enable companies of smaller size to participate in the data collection. The UKCG is exploring options to collect data from its members based on the methodology provided. The frequency of data reporting for the sector would most likely be annual.
- 6.10 A methodology for conducting water audits to identify water use by specific processes and activities has also been devised along with a number of accompanying pro-forma. These are found in Annexe D. At present there is very limited data on water use for specific processes and little is known of how water use for a particular process varies during the lifecycle of a construction site. Conducting water audits will provide important information in this area.
- 6.11 A matrix showing construction site type against construction phase has been created (Annexe E). This gives the possible combinations that can be subject to a water audit. The results of a water audit may vary depending on the site type (e.g. new domestic, new retail etc.) and the construction phase (e.g. remediation, commissioning etc.).

7. Challenges to reducing water usage on construction sites

7.1 Reducing water use on construction sites will be successful only if the following challenges can be overcome:

- **Value for money** As water is a relatively 'cheap' resource, it is unlikely that the introduction of expensive processes on temporary construction sites will be viable
- **The work environment** Any technology must be robust and able to stand up to the demands of construction sites
- **Habit** Behaviour change is not a process that will happen overnight and therefore technological intervention, or technology that actively influences a behaviour change (e.g. incorporation of trigger guns on all hoses) is likely to be more successful than purely behavioural interventions. A mix of approaches is more likely to be successful than considering either behaviour or technology in isolation

7.2 The other major challenge that the industry currently faces is a lack of understanding of where water is used on construction sites. Without understanding where water is used, and therefore where water is wasted, it will be very difficult to justify water conservation measures on sites. The Action Plan seeks to address this by encouraging and promoting water audit activity to obtain better information.

8. Water and Energy

8.1 Water use and energy use are inextricably linked. Energy is directly linked to water use at all stages of the supply process and by the end user:

- Water supply (abstraction, treatment and distribution)
- Water consumption (heating of water and water used/pumped)
- Wastewater (sewerage system pumping and wastewater treatment)

8.2 Thus a valuable driver for reducing water use on construction sites is provided by consideration of the impact on energy consumption of water use. Often, the cost of energy associated with water, for instance for pumping or heating water, is greater than the cost of the water itself. In addition, carbon savings can be calculated for savings associated with water conservation measures.

8.3 Water UK publishes a number of sustainability indicators³ relating to the water industry including greenhouse gases emitted in supplying water and treating wastewater. The 2008/2009 results are that:

- Greenhouse gases emitted in supplying water are 0.30 tonnes CO₂e per Megalitre water
- Greenhouse gases emitted in wastewater treatment are 0.75 tonnes CO₂e per Megalitre water

8.4 The volume of water used on construction sites that is returned to the sewer is currently unknown, therefore it is not possible to estimate the greenhouse gas emissions associated with that element. However, the volume of mains water used for construction sites is estimated to be 147.1m³ per £million contractors output at constant price. This is equivalent to 0.05 tonnes CO₂e per £million contractors output at constant price associated with mains water supply.

This means the total water use across the construction industry is equivalent to approximately 0.005 MtCO₂e used for treating and supplying water.

8.5 The carbon impact of directly abstracted water and rainwater harvesting will be substantially lower than this as there will not be use associated with:

- Water treatment to bring supply to potable standard
- Pumping of water for distribution purposes
- Leakage

It should be noted however that there could be on-site energy use associated with local pumping of directly abstracted and rainwater use.

3. www.water.org.uk/home/news/press-releases/sustainability-indicators-2008-09/sustainability-2009.pdf

9. An Action Plan for reducing water usage on construction sites

- 9.1 This Water Action Plan identifies a number of actions required to reduce water use on construction sites. If completed, these will contribute greatly to achieving the target of reducing water use by 20% by 2012. The actions will also result in a much more detailed understanding of the uses of water on construction sites leading to a greater understanding of how contractors can reduce wastage.
- 9.2 The priority for improving efficiency of water use in construction follows the following hierarchy:
- Eliminate water wastage on site
 - Improve efficiency of water using processes
 - Offset consumption of mains water with alternative sources such as rainwater harvesting
- Following this hierarchy maximises the environmental benefit of both water reductions, and carbon reduction.
- 9.3 There are two main aims of this Action Plan:
- To improve construction site water use behaviour
 - To improve understanding of water use on sites to allow focused action
- 9.4 The actions identified under each topic area range in their timescale and level of aspiration. Some are immediate actions that can be undertaken to result in either a quick-win in terms of reducing water consumption, or that will result in increased buy-in from stakeholders. Other actions are longer term, and require completion of prior actions before they can be implemented. Many require further development and support before they can be completed.
- 9.5 This Action Plan is intended to be a 'living' document, which will require regular updating as new activities and information becomes available.

A: Identify water use on construction site by process/activity

	Action	Lead partners
1	<p>Identification of water use on construction sites.</p> <p>Throughout 2011, collect data through water audits on construction sites to measure against the 2008 baseline.</p>	<p>UK Contractors Group (UKCG)</p> <p>WRAP</p> <p>Strategic Forum Water Subgroup</p> <p>Construction Key Performance Indicator Project</p>
2	<p>Identification of water use by process/activity on construction sites.</p> <p>By December 2011, conduct water audits on construction sites to allow the water use by specific processes/activities to be defined.</p>	<p>UKCG</p> <p>WRAP</p>
3	<p>Value the benefit of implementing efficient practice and behaviours</p> <p>By December 2011, value the economic benefit of reducing water use associated with different activities to support prioritisation of activities.</p> <p>Case studies developed from the water audits can be used to define and justify the benefit of implementing efficient practice and behaviours.</p>	<p>Strategic Forum Water Subgroup</p> <p>WRAP</p>
4	<p>Prioritisation of water using processes/activities on sites for focus to reduce water use</p> <p>By December 2011, develop prioritisation of water using processes on construction sites. Identify which processes use the majority of water; but also which processes are considered to waste the majority of water. Consider the water hierarchy (type of water e.g. displacing mains water with rainwater).</p>	<p>Strategic Forum Water Subgroup</p> <p>WRAP</p>
5	<p>Identification of water reduction actions for priority processes/activities</p> <p>By April 2012, identify, using best practice information, steps that can be taken for each priority area to reduce water use.</p>	<p>Strategic Forum Water Subgroup</p> <p>WRAP</p>
6	<p>Increase the level of detail of the target and progress measurement</p> <p>By April 2012, identify, using information collected by contractors, the types of construction project that have high water use and prioritise efficiency measures accordingly.</p>	<p>Strategic Forum Water Subgroup</p>

	Action	Lead partners
7	<p>Expand the level of detail of the target and progress measurement</p> <p>By April 2012, identify, using information collected by contractors and audit work, the water use associated with site preparation work (e.g. brownfield remediation, earthworks etc.) and the water use associated with landscaping.</p>	Strategic Forum Water Subgroup
8	<p>Expand the scope of coverage to include more manufacturing elements</p> <p>In the longer term (beyond 2012), identify those manufacturing processes for construction products which have high water use (the embodied water).</p>	<p>Strategic Forum Water Subgroup</p> <p>Construction Products Association</p>
9	<p>Water Footprinting</p> <p>In the longer term (beyond 2012), with improved access to embodied water information relating to construction products, identify the major water using elements of the life cycle of construction sites.</p>	<p>Strategic Forum Water Subgroup</p> <p>Construction Products Association</p>

B: Improve site water use behaviour

	Action	Lead partners
1	<p>Identification of best practice.</p> <p>By December 2011, identify best practice behaviours, processes and technologies for water using activities on construction sites.</p>	<p>Strategic Forum Water Subgroup</p> <p>WRAP</p>
2	<p>Promotion of best practice.</p> <p>By December 2011, liaise with SFFC Carbon and Waste Sub-groups and identify how and where to promote best practice.</p>	<p>Strategic Forum Water Subgroup</p> <p>WRAP</p>
3	<p>Promotion of best practice</p> <p>At all times, use relevant construction events to promote best practice.</p>	All
4	<p>Promotion of best practice</p> <p>By April 2012, produce best practice guidance document for reducing water use on construction sites, based upon best available knowledge.</p>	<p>Strategic Forum Water Subgroup</p> <p>CIRIA</p> <p>WRAP</p>
5	<p>Promotion of best practice</p> <p>Initiate discussion during 2011 to incorporate pre-design stage standards for water efficient construction sites into relevant schemes e.g. BREEAM and CEEQUAL.</p>	Strategic Forum Water Subgroup
6	<p>Initiate discussion during 2011 to specify a standard procurement requirement for water efficient construction sites, including accommodation, processes and materials within tender documentation for:</p> <p>Short term - Government construction procurement Medium term – Major construction clients (project value over £300,000)</p>	<p>Construction clients</p> <p>WRAP</p> <p>Defra</p>
7	<p>Ensure appropriate training available for:</p> <ul style="list-style-type: none"> • Incorporating water efficient construction practice at tender stage in design of sites • Environmental managers • Site managers <p>Consider review and revision of 'toolbox talks' to move towards standard environmental training accepted across industry.</p>	<p>CIRIA</p> <p>UKCG</p>
8	<p>During 2011, engage with the Modular and Portable Building Association to discuss the development of water efficient site accommodation</p>	Strategic Forum Water Subgroup

	Action	Lead partners
9	<p>During 2012, engage with construction equipment manufacturers to discuss the manufacture of water efficient equipment for use on construction sites</p> <p>E.g. hoses to have robust trigger guns to allow flow control at point of use.</p>	<p>Construction equipment manufacturers</p> <p>Strategic Forum Water Subgroup</p>

Annexes

- A. Water using processes and actions to reduce consumption**
- B. Methodology to derive a 2008 baseline**
- C. Water consumption data collection template**
- D. Water audit methodology**
- E. Matrix of sites for water audits**

Annexe A: Water using processes and actions to reduce consumption

To create an Action Plan to deliver the 2008 Strategy for Sustainable Construction water use target of:

“By 2012, water use in the manufacturing and construction phase to be reduced by 20% compared to 2008 usage”

it is necessary to identify where water is used on construction sites, where water is being wasted, and what behaviours and/or technologies can be introduced to reduce water wastage.

The UK Contractors Group (UKCG) initiated this process through the development of a matrix of water using processes and best practices relating to these processes.

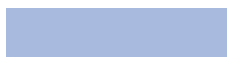
The matrix is provided on the next pages. Activities highlighted indicate those where it is thought the majority of water wastage occurs. Construction activity inevitably uses water; identifying areas where water is wasted will provide a focus for activities to reduce water consumption.

A variety of behaviours and technologies have been identified, however the practicality of these must be considered in the context of:

- **Value for money.** As water is a relatively 'cheap' resource, it is unlikely that introduction of very expensive processes etc. on temporary construction sites would be viable.
- **The work environment.** Any technology must be robust and able to stand up to the demands of construction sites.
- **Habit.** Behaviour change is not a process that will happen overnight and therefore technological intervention, or technology that actively influences a behaviour change (e.g. incorporation of trigger guns on all hoses) is likely to be more successful than purely behavioural interventions. A mix of approaches is more likely to be successful than considering either behaviour or technology in isolation.

Use of Water on Site (Processes/ Activities)	Procedures/ Systems	Estimated proportion of current water use on sites	Behaviours	Technologies	Scope for Saving (% reduction, £ saving or volume saving)
Design Stage Considerations (relating to water use impact of completed development)	Design out wet-trades BREEAM / Code / CEEQUAL - D&B projects	N/A	N/A	Water efficient bathroom products and taps should be installed.	N/A
Site Cabins/temporary accommodation					
Toilets, catering, washing (personnel)	Monitoring via meter readings etc. Rainwater collection and use		Site inspections for leaks, wastage / increase awareness through briefing and posters, notices. Awareness raising - toolbox talks / posters etc	Eco-cabins (e.g. rainwater harvesting, waterless or low or sensor activated flush urinals, water saving devices [taps] and effluent management system), composting, water meter adaptors to facilitate fitment of water meter to improve quality of data. Water meter adapter / add-on	Balfour Beatty Ecotoon system: up to £550 per month vs a conventional accommodation/ welfare unit.

Key:



High water using processes

Use of Water on Site (Processes/ Activities)	Procedures/ Systems	Estimated proportion of current water use on sites	Behaviours	Technologies	Scope for Saving (% reduction, £ saving or volume saving)
General site activities					
Tool washing Rinsing	Site inspections all to include checking for water leaks & use practices		Use toolbox talks to ensure operatives understand need to conserve water; Use buckets etc to wash tools rather than running water; Dedicated tool washing areas.	Auto shut-off taps. Ensure water supply able to be switched off at point of use e.g. through trigger guns on hoses.	
Wet Trades					
Brick/blockwork				On-site mortar silos as opposed to batch mixing	
Screeding					
Concreting	Concrete mix design		Use water from settled concrete wash out area to clean equipment	On-site batching using closed-loop water recycling	
Plastering					
Core Boring				Dry core	
Lightweight Roofing					
Ceramic Tile					
Bentonite mixing				On-site batching using closed-loop water recycling	
Rendering					
Groundworks					
Grouting				Auto shut-off taps (e.g. trigger type hoses/taps)	
Drilling/Piling	Flushing water / coolant				

Use of Water on Site (Processes/Activities)	Procedures/Systems	Estimated proportion of current water use on sites	Behaviours	Technologies	Scope for Saving (% reduction, £ saving or volume saving)
Dust Suppression					
General, site roads, wheel washes	<p>Water spraying bowsers (using water diffusers to create mist as more effective at capturing dust)</p> <p>Rainwater collection</p> <p>Early hard-standing (or stone) site roads, car parks etc (reduce requirement for damping down)</p>	Considered to be the largest 'wasteful' use of water on sites.	Licensed water abstraction (surface water / boreholes)	<p>Use temporary settlement lagoons and look at early construction of lagoons so that they can be utilised early</p> <p>Closed-loop water recycling for drive-through wheel-washes</p> <p>Admixtures for dust suppression (case study to follow from Bam Construct) - reduces damping frequency</p> <p>DustClear from Odour and Dust Solution Ltd is biodegradable and binds together dust and floating parts to reduce damping.</p>	
Hydro-demolition with high pressure water		(High on sites where this is used)		Closed-loop water recycling	
Cleaning					
Cleaning tools and small equipment			Use buckets as opposed to running water		
Plant & equipment				Closed loop systems	
Lorry wash out				Recovery of water for re-use	

Use of Water on Site (Processes/Activities)	Procedures/Systems	Estimated proportion of current water use on sites	Behaviours	Technologies	Scope for Saving (% reduction, £ saving or volume saving)
Ready mixed concrete wagons	Wash out into segregated area			Wash out pit with recirculation system to re-use water in concrete mixes	
Site / general cleaning					
Specialist / high pressure cleaning					
Paintbrush washing				Dulux system Azko Nobel system	
Commissioning & Test					
Building plant/ services	Capture and re-use of commissioning water				

Key:



High water using processes

Best practice examples:

Selected best practice examples are highlighted below; these are by no means exhaustive. Where possible, estimations of the quantity of water saved through intervention are provided.

Willmott Dixon

Willmott Dixon report in their 2009 Sustainability Review⁴ that they are developing a Water Improvement Plan for sites. Willmott have successfully trialled new technology – eco-cube™ biotechnology in site welfare facility urinals. The introduction of the product has avoided the need for water for flushing and is currently installed at over 85% of sites in operation. It is estimated this system saves 6.3 million litres of water a year.

In 2007 Willmott reported that their water use on construction sites was 28,694m³. Based on this data, the introduction of this technology alone could save **over 20% of water used.**

Olympic sites

A major example of water efficiency in construction is the Olympic sites⁵:

Site offices have been fitted with waterless urinals and low-flow taps and showers.

Water used for soil washing and dust suppression is being recycled. Water collected by road sweepers is being treated and recycled, at around 80,000 litres per day. Once the water has been cleaned by mobile silt trap and centrifuge system, it is used for soil washing, road sweeping and dust suppression.

Balfour Beatty⁶

Balfour Beatty has focussed on reducing water usage in their premises through the use of self-closing taps, waterless urinals and staff awareness campaigns. On construction sites, systems to capture rainwater for plant cleaning and concrete batching, or re-use in eco-friendly site cabins and for dust suppression, have been installed.

Relative to revenue, Balfour Beatty's global use of water decreased by 18% from 208 m³/£million revenue in 2005 to 170 m³ per £million revenue in 2008.

Concrete Industry

The concrete industry currently has a performance indicator for water. They aim to use water efficiently and minimise the demand on mains water. The industry is working to promote good practice. These practices include the use of admixtures in concrete production (which can reduce water consumption by up to 30%) and water recycling.

Values are reported for various sectors of the concrete industry. These are given in the Industry Sustainability Performance Report⁷. The unit of measurement is litres of water per tonne of product. For instance, ready mixed concrete is given as 59 l/t, whilst precast is 110 l/tonne.

4. www.willmottdixongroup.co.uk/aboutus/sdreview2009.asp accessed 18th February 2010.

5. www.london2012.com/documents/oda-publications/sustainability-update-interactive.pdf

6. www.balfourbeatty.com/bby/media/publications/2009publ/vision_roadmap/vision_roadmap.pdf

7. www.britishprecast.org/10063CCSCSPerformanceReportFinal.pdf.pdf

Annexe B: Methodology to derive a 2008 baseline for Construction Sites

A scoping study carried out in 2009 identified that water used on construction sites can be both directly abstracted, and also sourced from mains water supplied by a water utility. For this reason, the methodology has considered each of these water sources separately. A variety of potential data sources were suggested by the Strategic Forum Water Subgroup. A summary of these suggestions and the outcome of investigations into them are given in Annexe B1.

One major source of potential data was identified as work carried out by Envirowise. Envirowise completed a review of water use across different sectors (separated by Standard Industrial Classification (SIC) codes) in 2007. The study looked at all industrial water use and did not focus specifically on construction. Due to the wide scope of the study it was necessary to make a number of assumptions which were applied consistently across sectors. It is acknowledged that this is a limitation of the study.

a) Directly abstracted water

The Environment Agency's (EA) National Abstraction Licensing Database (NALD) contains classification information on the type of business holding an abstraction licence. This includes a classification of Construction (CON) being 'Water used on construction sites of any kind, e.g. buildings, tunnels, pipelines, bridges, roads'.

The Envirowise work included an estimate of consumption by the construction industry for directly abstracted water. From discussion with Envirowise it is evident that NALD datasets can misclassify industry type, and therefore for the purposes of their analysis Envirowise included a number of other NALD licenses that were not initially identified as construction, but were felt to fit into the SIC classification of construction. Similarly, there are some NALD construction types which relate to construction material manufacture rather than the act of construction itself.

The Envirowise analysis looked at 55 sites which were considered to be part of the construction sector, and identified both the 'maximum authorised' and 'reported returns' information. 32 out of the 55 sites had 'returns' values, which averaged approximately 25% of the maximum authorised abstraction volume. This percentage has been applied to the maximum authorised across all 55 sites. The Environment Agency have confirmed that where a null value would have been seen in the database it indicates that returns data had not yet been received, rather than a zero value, so this assumption is valid.

The total abstracted water consumption is therefore estimated by Envirowise to be 10,704,369m³ water for the 55 sites (average 194,624m³ per site).

How robust is this value?

The main issues with this value are:

- Data is from 2000 – 2004.
- An EA analysis of return data for 2006 suggests a total of approximately 50% of the Envirowise figure.
- The 'returns' data is extrapolated to all sites. Those sites that do not provide 'returns' data might not be abstracting any water and therefore this might be a significant over-estimation of actual consumption.

- The coding of the NALD database does not align directly with SIC codes. The EA have highlighted that potentially some manufacturing industries, e.g. Cemex, Tarmac, are included within this analysis and therefore could be skewing the results.
- Actual data from a large construction company indicates that use of abstracted water on sites is very small (average 0.5m³ per site across 1700 sites, although only approximately 110 of these sites used abstracted water).

The Environment Agency has extracted the 2006 – 2008 NALD data for construction. This data shows a significant reduction for the 'construction' category in consumption, reducing from around 5,000,000m³ in 2006 to around 3,000,000m³ in 2008 (note, these numbers have not been scaled up to estimate a value for non-returns). Again, for this data, the majority of licences appear to have been granted to construction products manufacturers and suppliers (aggregates, cement and concrete products) rather than construction contractors for use on sites. In 2008, around 30% of licences appear to be to contractors, accounting for only 2% of the total returns volume.

The Office of National Statistics (ONS) published updated UK Environmental Accounts⁸ in February 2010. These include a section on both directly abstracted water and public water supply. These accounts estimate that directly abstracted water use in the construction industry was 6 million m³ in 2006/7. This includes an estimation of water use for no-return fields.

If this volume of water is used to estimate the proportion that is contractor's use on construction sites (2%), the volume of directly abstracted water is calculated to be 120,000m³, or 1.25m³ per £million contractors output at constant price.

b) Mains-fed water

There is no single source of mains water consumption data for construction sites. Various potential sources have been identified, each of which offers an incomplete picture of consumption.

i) Envirowise analysis

Envirowise' analysis used available public register (Pollution Prevention and Control (PPC)) data to estimate the mains water consumption of construction sites. However, only 3 data points were available for this and these have been extrapolated to provide an estimate of consumption for over 16000 businesses. As this data came from PPC, it is likely these three data points represent unusual construction sites or sites manufacturing construction products. Envirowise have provided further information regarding how they apportioned water use to account for sites of different size. The study used 'UK local units in VAT-based enterprises' from ONS data. This means that a distinction between businesses and sites is made.

As the focus of the study was on industrial water use, the report has excluded consideration of water consumption of 'sole trader' businesses, as it is believed their main consumption would be domestic uses. For medium and large businesses it was assumed that a large business used twice as much water as a medium business, and that there were twice as many medium sized businesses as large.

A further assumption has been made that as these three sites used only mains-fed water, that all construction sites use mains-fed water. Therefore, at the 55 sites that had abstraction licenses, it is assumed that they also use mains-fed water.

The total mains-fed water use is estimated to be 153,076,076m³ in England and Wales. This is equivalent to 1596m³ per £million contractor output at constant price.

8. Available at www.statistics.gov.uk/downloads/theme_environment/EA-Feb10.pdf accessed 16th March 2010

How robust is this value?

This estimation of water use appears exceptionally high. It is an order of magnitude out of line with any other estimation that we have been able to find. Potential reasons for this include:

- Extrapolation of just 3 data points.
- Potential double counting of water use at sites which also directly abstract.

ii) Water Industry data

A number of individual water utilities were contacted for this study to determine the extent to which they collect data regarding construction site water consumption. The responses received were varied, with some utilities collecting quite accurate data, and others having very little data. A summary of responses (anonymous at the utilities' request) can be found in Annexe B2.

Data provided by one company estimated total water use for construction as 2,467,035 m³ for the year 2008/09 (c.f. 3,043,735m³ in 2007/08). The data is derived from both billed data for construction activities, where a new metered supply is put into a development for use during construction and also estimations of water used for construction which is not measured. This is the case where an existing permanent water supply is not available and therefore developers are charged a fixed fee for access to the potable water network. Typically the developer will then install a temporary supply, either a standpipe or similar arrangement. They will use as much water as needed, however volumes used are generally not recorded.

The area of operation for this company is a very close fit with one of the Regional Development Agency (RDA) Areas. The value of work in this area in 2008 is reported as £13,120 Million. This equates to 188 m³/£million of contractor output (note, this is at current prices, rather than constant prices).

The total value of work carried out in England and Wales in 2008 amounted to £111,212 Million at current prices. Extrapolating this water utility data gives an estimated total water use of 20,907,856 m³ from mains water use. This equates to 218m³ per £million contractors output at constant prices.

iii) Environment Agency data

The Environment Agency (EA) are currently completing an analysis of the 2006/7 baseline non-household demand figures in the Water Company draft Water Resource Plans (dWRP) (note, it is not anticipated that these figures will significantly change between the draft and final plans). Where companies have not used the standard template that includes the SIC code for construction, a matrix has been devised to allocate figures where appropriate.

The EA have provided their results of this analysis, which has not extrapolated or estimated for companies where no figure for construction exists. The total estimated mains water consumption for construction is 11.6 million m³ per year (2006/7 figures). Figures are missing for 2 companies, with one company reporting 0m³. In addition there are no figures for Dwr Cymru Welsh Water.

The total value of work carried out in England in 2006 amounted to £96,831 Million. This equates to 120m³ per £million contractors output (mains water only).

Due to the missing data for two sizeable water utilities, we have analysed the available data to determine an estimate of consumption across the missing regions. The details of this is available in Annex B2. The resultant water consumption for England is 12.9 million m³ per year (2006/07), equivalent to 133.5m³ per £million contractors output.

iv) ONS Environmental Accounts data

The UK Environmental Accounts include an estimation of public water supply used for Construction. The approach taken for this piece of work was similar as that by the Environment Agency, using data from Water Resources Plans. The estimated water use by Construction was 12 million m³ in 2006/7 across England and Wales.

The total value of work carried out in England and Wales in 2006 amounted to £101,304 Million (at current price). This equates to 118m³ per £million contractors output (mains water only).

v) Construction Industry data

Although there is no single source of data which has compiled individual construction company records of water consumption, we are aware that a number of companies have been monitoring consumption over recent years.

Balfour Beatty⁹

In 2008, across the UK, 242,800m³ water was used for project site work, of which only 920m³ was directly abstracted. This consumption is equivalent to 143m³ per site. If all Balfour water use is included, it is equivalent to 412m³ per site, or 112m³ per £million sales. These values are considerably lower than those provided by the Envirowise analysis, but in the same order as the Water Industry data discussed earlier.

Balfour have also provided a breakdown into three divisions:

- Buildings division: 43.8m³ per £million revenue.
- Civils division: 117.6m³ per £million revenue.
- Rail division: 146.6m³ per £million revenue (note, this includes a significant manufacturing element).

Willmott Dixon¹⁰

Published water consumption data reports that in 2007 they used 129m³/£million project value, and in 2008 this decreased slightly to 125m³.

Vinci Construction

Water used for construction has been collected for 2009 and therefore has not been used to inform the baseline, but provides an indication of the scale of water use. The 2009 average usage across the company is calculated at 117m³ per £million turnover. This is broadly in line with the proposed baseline.

9. www.balfourbeatty.com

10. <http://vcat.star-digital.co.uk/?userpath=00000013/00001135/00031768/&page=28> accessed 17th February 2010

Vinci are able to provide a breakdown into four division of business:

- Building division (schools, hospitals, commercial etc.): 94m³ / £million.
- Air division (works at Heathrow and Gatwick): 213m³ / £million.
- Civil engineering division (rail, road, energy etc.): 312m³ / £million.
- Bulk excavation (earthworks): 173m³ / £million.

It is clear from these figures that 'building division' work, which typically would have a defined construction site, has far lower water consumption than other types of construction work.

Bovis Lend Lease

A best estimate of water use for 2008 has been given at 194m³ per £million turnover. This value includes all project phases including demolition, earthworks and construction.

Summary of Water Use Data

The 2008 Baseline is believed to be between 112 and 189 m³ per £million contractor output (at current prices).

- 112 m³ represents the minimum value reported by the construction industry for 2008.
- 189 m³ represents the appraisal of mains water from scaling up water utility data based on value of construction work (188 m³ per £million value current prices) plus the 2008 proportion of contractor abstraction taken (1.1 m³ per £million value at current prices). This is likely to be the least robust value due to the level of extrapolation of information necessary.

Analysis by the EA, and subsequent adjustment, suggests that water use for construction from mains water is approximately 133.5 m³ per £million contractors output at current prices. The ONS Environmental Accounts indicates that water use for construction is approximately 120 m³ per £million contractors output at current prices.

The baseline suggested reflects the average of the two most robust data sources (126.8 m³ per £million contractors output at current prices) and takes into account water that is directly abstracted for use on construction sites (1.1 m³ per £million contractors output at current prices). It is also in-line with the available construction company reported data on water use on construction sites.

The value of 128m³ per £million contractors output at current prices has been converted to reflect a unit based on 'constant' prices that takes into account inflationary factors. The conversion has been reviewed by Nobel Francis, economist at the CPA. The calculated contractors output value for England and Wales in 2008 at constant prices is £95,890 million (c.f. £111,212 million at current prices).

The baseline has therefore been recalculated as 148m³ per £million contractors output at constant prices.

There is not currently adequate information to accurately provide a baseline for different types of construction project e.g. buildings, civils etc. However, it is anticipated that in the future this will be possible once better data is available directly from contractor's records of water consumption on sites. The current baseline contains all elements of water consumption associated with contractor's site activity.

Agreed 2008 baseline water use: 148 m³ per £million contractors output at constant price

Consideration has been given to alternative units for the baseline in addition to the economic unit of value of contractors output. Units considered included a spatial metric such as m³ water per m² of built floorspace and m³ water per m of lineal road works or pipe emplacement on projects with significant civil elements or proportions.

In the future, as higher resolution water use data becomes available following data collection activities by contractors, it might be possible to provide a range of benchmarks and metrics against m² floor space constructed, length of road or pipe emplacement completed and number of new homes completed.

Methodology for measuring progress towards the delivery of the water use target

Construction sites

The data available to use for derivation of a 2008 baseline, and the methodologies used to both derive those data and then collate them, do not represent a highly robust method which should be repeated in coming years to measure progress.

It is anticipated that over coming years, the construction industry, and in particular contractors on site, will collect more data on water consumption and that this data will be the most robust source to use to measure progress to the water use target for the construction industry.

A pro-forma for data collection has been devised. The pro-forma (found in Annexe C) allows data on construction and project type, value of the project and duration of project to be collected on a monthly basis.

The UK Contractors Group (UKCG) has suggested that this data should be collected for all projects over £300,000 value, and as best-practice for projects of lower value. It is anticipated that the publication of this pro-forma will enable other companies of smaller size to participate in data collection.

A methodology for conducting water audits to identify water use by specific processes/activities has been devised along with a number of accompanying pro-formas (found in Annexe D). At present there is very limited data on water use for specific processes and little is known of how water use for a particular process varies during the lifecycle of a construction site. Conducting water audits will provide important information in this area.

A matrix showing construction site type against construction phase has been created (found in Annexe E). This gives the possible combinations that can be subject to a water audit. The results of a water audit may vary depending on the site type (e.g. new domestic, new retail etc.) and the construction phase (e.g. remediation, commissioning etc.).

Other Contractor activities

The target is to be measured in units of m³ per £million contractors output. Construction sites are just one area where contractors use water in their day to day activities. There is also water consumption associated with office buildings (e.g. company headquarters) and any other depots that the company might own where activities such as wheel washing might also occur. It is important that this consumption is not overlooked as figures from Balfour Beatty¹¹ suggest that two thirds of their consumption comes from off-site activities.

Fixed site water monitoring should be a relatively simple activity. For mains-fed water at least annual information should be available from the relevant Water Utility.

For companies unable to provide this information it is suggested that two figures can be calculated:

- m³ per £ million contractors output for project site water only across all contractors.
- m³ per £ million contractors output for project site water only for contractors with additional information available.
- m³ per £ million contractors output for all consumption for contractors with additional information available.

11. www.balfourbeatty.co.uk/bby/responsibility/performance/environment-data-other

These three pieces of information can then be used to scale up the consumption for companies where additional information is not available.

Methodology in relation to 2008 Baseline derivation

It is recognised that this proposed methodology differs from the methodology used to derive the 2008 baseline. However, the focus of the work of the group is on the future sustainability of water use in construction and manufacturing and it is clear that there is no single data set to use to derive the 2008 baseline. Therefore, it is anticipated that whilst a baseline will be agreed by the group, it might be necessary in future years to provide clarification around any differences between the baseline and future reporting.

The 2008 baseline will as far as possible be derived using site level data, however currently information is only available for two contractor companies.

Annexe B1: Potential sources of data

Recommendation	Water Resources Plans
<p>Progress</p>	<p>A review of selected Water Company Water Resource Plans shows that some companies do not have specific figures for water use by construction. For companies that do, it is not entirely clear where figures are derived from. It may be a general figure for water use per property, multiplied by the number of properties or new billed connections made. Alternatively, it may be derived from commercial metering data and the proportion of this which is estimated to be construction.</p> <p>The Environment Agency are doing further work looking at the draft Water Resources Plans and using available data to estimate construction use. This is detailed in Annexe B.</p> <p>Water Utility specific contacts</p> <p>We have discussed with various companies whether or not they have more information than is reported in the dWRMPs. Note, several companies asked to remain anonymous and therefore we have removed reference to individual water utilities here. From our conversations it appears some companies will provide a metered connection to a new development site when the site office is established, and will be able to meter water use for the entire development. Information ought to be available for each site this way, and by correlating with planning information on development size, a figure can be derived per property. This water use will also include washing, drinking, cooking and non-construction associated activities.</p> <p>Metering is only likely to happen for larger construction sites. Smaller sites will hire a standpipe, typically from a plant hire company. These may be charged on a flat rate or a volumetric basis. Meter records should be passed back to the water companies, although the reason for each hire may not be recorded.</p> <p>Water utility A</p> <p>In the majority of cases, a new supply would be put in for a new development, which will be metered. This supply would be taken from an existing main. Once the development is completed, the connection is either disconnected or turned into the main connection for the development. This will often be in 22 or 32mm, and initially is to supply the site office. Water utility A believe they have some records of meter use which they will be able to tie into development size to give an idea of water use on construction sites.</p> <p>Metered standpipes may be used, but this is managed on behalf of Company A by a Building Supplies Company, they believe that actual breakdown of standpipe hire for different purposes is probably not recorded (i.e. the company don't ask them what they are going to use the water for). There is believed to be an element of unauthorised use on some sites.</p> <p>Water utility A have agreed to send some further information on metered supplies and development sizes if possible.</p>

<p>Progress</p>	<p>Water utility B Construction companies hire metered standpipes from a plant hire company. Information on volumes used is passed back to water utility B although who the equipment is rented to, or the intended use of the water is not recorded. It is believed that most is used for temporary building work, although some may be used for cleaning, flushing drains etc. Recorded use in 2008/09 was 120m³/d.</p> <p>There is also a code for temporary connections, although there are no details on intended use. In 2008/09 57m³/d consumption was recorded. It is not thought that many construction sites are captured in this dataset.</p> <p>Some big developments will have a metered supply put in, and they have agreed to try to find some information on this. It is assumed that standpipe hire is mostly for construction purposes.</p> <p>Water utility C The contact did not have information to hand, but have agreed to find out and send us further information.</p> <p>Water utility D Tend to hire out standpipes on a standard charge. Have some figures for construction use. Possibly derived from numbers of properties in developments and an estimated water use associated with a typical property.</p> <p>Water use is captured as 'billed consumption' and 'building water (unbilled)'. Billed consumption is metered water taken from the potable water network and billed as a commercial user. Building water is used where a development is not connected to the potable water network, and a fixed fee is charged for use of a standpipe or similar. Water use is not restricted and volumes are not recorded.</p> <p>Billed consumption is reported in the draft Water Resource Management Plans, and although metered for construction sites, may include non-construction uses such as domestic and toilet flushing.</p> <p>Unbilled use is reported in the June Return to Ofwat, and volumes are estimated from the size of development.</p> <p>In theory the two numbers may be added to provide a total.</p> <p>Water utility E This utility are taking a top down approach to reporting and predicting commercial water use by industry type (it is likely that all commercial use is divided up into different groups using SIC codes to derive water use by industry type) General economic predictions are then used to project forward. They will try to provide some further information.</p>
<p>Recommendation</p>	<p>"Do companies have separate meters for trade effluent? Reporting on water under environmental PPC (pollution prevention and control) is voluntary."</p>

<p>Progress</p>	<p>Construction sites will usually be controlled by setting a discharge consent under the Water Resources Act 1991 (a WRA consent) for site drainage, and there used to be a standard method for determining the size of a settlement pond needed. The discharge would be rainfall related from the settlement ponds which acted as a flow balancing pond.</p> <p>Roger Saxon (EA national discharge consent regulation team) tells us that discharge volumes are not recorded, and in any case they would expect most of the discharge to be rainwater.</p> <p>Enquiries have been made with trade effluent managers at water companies and we are waiting to hear from them.</p>
<p>Recommendation</p>	<p>“Regular reporting is carried out under EA NALD (National abstraction licensing database) as companies are required to report how much water they actually abstract. This information could be available to aid analysis to define a 2008 baseline.”</p>
	<p>4/000 ‘main trades’ firms.</p>
<p>Recommendation</p>	<p>“Is there anyone who collates CSR reporting information? (No-one knew of anyone who did this).”</p>
<p>Progress</p>	<p>We have not been able to identify any organisation or website which collates this information into one place. Various individual companies are now starting to report information relating to water use in construction as water resources work their way up the agenda of sustainability priorities. We will use as much of this data as possible to verify the Envirowise figures.</p>
<p>Recommendation</p>	<p>“Association of Chartered Certified Accountants (ACCA) sustainability reports may be another possible source of data.”</p>
<p>Progress</p>	<p>We have reviewed the ACCA sustainability section of their website and have been unable to locate anything relating specifically to a particular sector. The sustainability reporting requirements appear however to be closely aligned to KPI reporting requirements therefore we will focus on getting more information relating to the KPIs.</p>
<p>Recommendation</p>	<p>“Industry is likely to have changed between 1998 and 2008, however some factors will have caused increased consumption and others will have caused decreased consumption. Could look at case-studies to determine changes e.g. ‘nibbling’ for ground breaking (less dust – less water required for damping down).”</p>
<p>Progress</p>	<p>We have not looked at this area yet as it will not provide specific figures or datasets which are required as a starting point.</p> <p>We will look at best practice for reducing water consumption and estimate the savings to be achieved which will allow us to estimate how far towards achieving the target we might be able to get.</p>

Annexe B2: Estimation of ‘missing’ construction water use data

Estimation by water utility size

Table B.I provides a comparison of water utility size by number of billed customers from the Environment Agency analysis of construction use water consumption data from draft Water Resource Plans.

The percentages of total customers in the UK are compared to the percentage of total construction water use data for each company to determine if the number of customers can be taken as a proxy for water use in construction for the two companies that have no data available for construction.

Table B.I: Water utility size by number of billed customers and water use for construction taken from draft Water Resources Plans.

Utility	Total customers (household and non household)	percentage of total customers	MI/d	MI/yr	MI/yr percentage of total for England
Anglian	1,972,338	8.92%	2.61	951	8.20%
Bournemouth & W Hampshire	190,230	0.86%	-	-	-
Bristol	485,487	2.20%	2.15	785	6.76%
Cambridge	122,662	0.55%	-	-	-
Cholderton Water	727	0.00%	-	-	-
Dee Valley	114,478	0.52%	-	-	-
Folkestone & Dover	72,293	0.33%	0.10	38	0.32%
Mid Kent	246,932	1.12%	-	-	-
Northumbrian (inc. Essex & Suffolk)	1,847,346	8.35%	-	-	-
Portsmouth	293,223	1.33%	0.54	197	1.70%
Severn Trent	3,306,748	14.95%	1.35	493	4.25%
South East Water	596,487	2.70%	1.51	551	4.75%

Utility	Total customers (household and non household)	percentage of total customers	MI/d	MI/yr	MI/yr percentage of total for England
South Staffordshire	541,647	2.45%	6.56	2395	20.64%
South West	740,767	3.35%	0.44	162	1.39%
Southern	1,012,680	4.58%	1.46	533	4.59%
Sutton & East Surrey	264,336	1.20%	0.00	0	0.00%
Tending Hundred	71,368	0.32%	0.04	16	0.14%
Thames	3,447,297	15.59%	4.84	1766	15.22%
Three Valleys	1,238,887	5.60%	0.94	344	2.97%
United Utilities	2,964,616	13.41%	3.31	1209	10.42%
Wessex	543,262	2.46%	0.32	116	1.00%
Yorkshire	2,041,744	9.23%	5.61	2049	17.66%
total customers	22,115,555	100.00%	32	11,606	100.00%

(Source http://www.ofwat.gov.uk/faq/prs_faq_howmanycust.pdf , 2006/07 figures from Table 8 in company draft Water Resource Management Plans

Although this is only a crude comparison, some companies construction water use reflects their size quite well. Anglian Water have 8.92% of the billed customers in England, and their reported construction water use is 8.20% of the total reported by the Industry. Similarly, Portsmouth, Southern and Thames water use percentages are very similar to the percentage of utility size.

Some companies' figures are quite different. South Staffordshire Water, despite only having 2.45% of the billed customers in England, appear to be responsible for over 20% of the water used in England for construction. In fact, their reported water use, at 2395 MI/yr is greater than that of Thames and Southern Water combined.

These discrepancies are not just restricted to small companies where large construction activities might distort the water usage figures. Severn Trent, despite having almost 15% of the billed customers in England report only 4.25% of the total water use for construction. Yorkshire Water have 9.23% of billed customers, but report 17.66% of construction water use in England.

Not all companies have reported water use data, and the shortfall equates to 2,522,375 customers – 11.4% of billed customers.

Assuming that the total construction water use is broadly correct - accepting that some companies are using more than expected, and some are using less than expected – then an extra 11.4% of water use would equate to an extra 1,323 MI/yr, bringing the total to 12,929,000 m³ per year.

Consideration of Regional Development Agencies

In 2006 a total value for construction industry output of £96,831 million was reported for England. Against a reported total water use by water companies in the draft Water Resources Plans of 11,606,000 m³ per year, this equates to 119.86 m³/£million contractors output in 2006.

Assuming that the actual water use total is 12,929,000m³ per year (as above), this increases the figure to 133.5 m³/£million contractors output in 2006.

Figures for contractors output are also available at the Regional Development Agency level (Table B.2).

Table B.2: Construction Industry Contractors Output 2006

	2006 £million contractors output
North East	£4,125
Yorkshire & the Humber	£9,343
Midlands	£17,893
East of England:	£11,393
Greater London	£16,426
South East:	£16,447
South West	£9,499
North West	£11,705
Total for England	£96,831

Source: Office for National Statistics

Matching the RDA regions to water company boundaries is difficult as, generally, RDA regions do not follow water company boundaries, and a certain amount of estimation is needed to try to map them.

However, the Northeast RDA does provide a close match for United Utilities. Here, UU reported 1209 Ml/yr water use, and the ONS report £11,705 million contractors output. This gives a figure of 103.30 m³ per £million contractors output.

The Yorkshire and Northeast region provides a reasonably good match for the operating areas of Yorkshire Water and Northumbrian Water. Reported total water use for Yorkshire is 2049 Ml/yr. Northumbrian did not report any water use, but assuming that their customer share is 8.35% of a total of 12,929 Mld, then their water use may be 1080 Ml/yr (see above). This gives a total of 3129 Ml/yr. Divided by the Yorkshire and Northeast total of £9343 million plus £4125 million this gives a figure of 232 m³ per £million contractors output. This is clearly over twice the value reported for the Northeast/ United Utilities. It should be noted that Yorkshire reported very large water use in

their area, and the Northumbrian value was derived on the assumption that their use was typical of the national average for company size.

The Midlands RDA covers an area roughly the size of Severn Trent, although it includes parts of Welsh Water, Anglian and Yorkshire Water. For the purposes of estimating it was felt that it could be compared directly with Severn Trent. Severn Trent water use was reported at 493 Ml/yr which appeared very low for the size of company. The Midlands RDA reported a contractor output of £17,893 million. This gives a value of 28 m³ per £million contractors output, which is very low in comparison to other regions.

The South West RDA roughly covers Southwest water, Bristol Water and Wessex Water. Total reported water use for these companies is 1,062 Ml/yr, and contractor output is £9,499 million. This gives a water use of 112 m³ per £million contractors output, which is broadly consistent with other regions.

The southeast is a complex patchwork of water companies, and it was not thought practical to try and compare RDA outputs in this area.

Annexe C: Water consumption data collection template

A data collection pro-forma has been developed by the UK Contractors Group. The detail is presented in the following pages.

Notes

UKCG Environmental Group

Protocol for measuring water consumption during the construction process

Collecting data on water consumption during the construction process will provide the following benefits:

Understanding and managing costs

Reducing environmental impact of overuse

Measure to manage - benchmark performance

Gain credits under BREEAM, CEEQUAL, Code for Sustainable Homes

Demonstrate continual improvement with regards to ISO 14001 / EMAS

Demonstrate best practice & meet customer expectations

**Key data required for reporting to the UKCG:
Metres cubed of water per £100,000 value over 12-month period**

Data should be reported for all projects >£300,000. For projects below this threshold, reporting is optional

Mandatory data includes:

Mains water where the contractor is responsible for billing / metering

Licensed water abstractions

Water transported to sited (bowsers / tankers)

Value of work that the water data relates to

Optional information:

Workforce that the water data relates to (direct and subcontracted staff)

Details of initiatives or good practice to reduce potable water consumption (e.g. rainwater recycling, other water recycling etc)

Estimated water saved via initiatives / good practice

Exclusions:

Water provided and paid for by the customer

Rainwater collected on site, e.g. lagoons, rainwater harvesting systems

Data must be reported to the UKCG annually, in line with annual KPI reporting

A template is provided on sheets 2 and 3 for use in the absence of existing data collection systems

The project data collection form can be duplicated for use for >1 project, which will feed into the Company data form. See user guide.

The company data collection form can be used to report headline figures required by UKCG

Company level data (compilation of site data)

Company name:

Reporting year (January to December):

2010

Mandatory:

Volume of water used during the reporting period (m³):

Value of work the above metric applies to:

Metres cubed of water per £100,000 value:

0
1000000
0

Optional:

Average number of people on site per month during reporting period:

Average water use per person during the reporting period:

0

If you are copying returned sheets from projects into this workbook, please use the button on the right to update the data in the cells automatically. If you are entering the data manually, do not click this button as it will over-write your entry.

Project data collection

UKCG Environmental Group: Working Group 2 - Water
Protocol for Water Measurement on Construction Sites

To be used where contractor is responsible for water supply

Project name	
Project value	
Project duration (months)	
Project sector	
Project type	
Construction type	
Applicable assessment	
Data collection method (mains water)	
Data collection method (abstracted water)	

Water consumption data required for all projects >£300k, good practice for <£300k

0.276	kg CO ₂ / m ³ - based on 2009 Guidelines to Defra / DECC's GHG Conversion Factors for Company Reporting
0	Total CO ₂ (kg) for mains water use
0	Total water used for the year (m ³)
	Total value of works in the reporting period (£)
	Volume of water used (m ³) / £100,000
0	Average number of staff on site per month

	Year (2010)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Number of direct staff												
Number of subcontractor staff												
Total staff	0	0	0	0	0	0	0	0	0	0	0	0
Mains water use (m ³)												
Abstracted water use (m ³)												
Water transported to site (m ³) (tanker / bowser)												
Total water use (m ³)	0	0	0	0	0	0	0	0	0	0	0	0
Water use, m ³ / person / month												
Water use, m ³ / person / £100,000												

Notes:

Project name is only required for company internal use. This does not need to be submitted to UKCG

The 'Project sector', 'Project type', and 'Construction type' information could be used to assess whether these classifications have an impact on water use

This sheet should be used to record data for an individual project. Linked spread sheets can be used to collate data from various projects, taking into account the sector, type and construction type. The collated data can then be submitted to UKCG, potentially sorted by category

England & Wales - water abstraction of >20 m³/day from ground or surface water will require an abstraction licence which may include conditions including how consumption is assessed (meter, hours run, pump capacity etc)

Scotland - water abstraction of >10 m³ but <50 m³ from inland and ground water require registration, as do abstractions >10 m³ from coastal waters and estuaries

Annexe D: Water audit methodology use data

This methodology has been prepared to allow contractors to self-audit construction sites. Following these steps will allow robust data collection on water consumption across a variety of site processes, which will subsequently allow areas of high water consumption and water wastage to be identified for improvement.

A series of supporting checklists and data collection pro-forma accompany this methodology and are referred to below.

Water audit procedure flowchart

Figure 2 below summarises the process of carrying out a water audit.

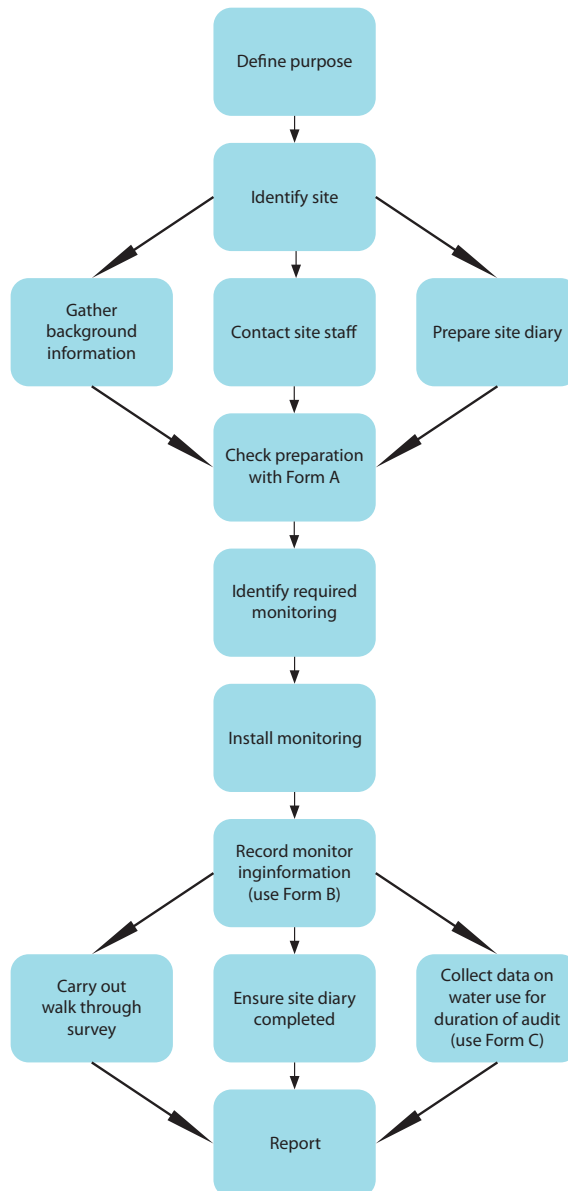


Figure 2: Water audit procedure flowchart

Preparation

Thorough preparation for a water audit ensures maximum results and efficiency. During the preparation phase, Form A should be completed as a record that correct preparation has been carried out.

1. Define purpose of water audit, for example:

- A. "To determine the overall water use of the construction site";
- B. "To determine the water use of a particular process or technology";
- C. "To determine the water savings associated with implementation of a particular behaviour change";
- D. "To determine the impact of using efficient product X instead of standard product Y"; or
- E. "To determine the volume of water used by site accommodation on the construction site".

2. Identify site for water audit:

- A. Consider the type of site, i.e. new domestic, new infrastructure (specify as road, rail, flood defence or structure, such as bridge for example), new retail, new office, new education, new health, new other non-domestic or refurbishment & maintenance. This is particularly important if the water audit is to compliment prior audits.
- B. Consider the phase of construction in which the audit is due to take place and any time limitations if the audit is intended for a particular construction phase. This is particularly important if the purpose of the water audit is to determine the water use of a particular process or technology during a certain construction phase.

3. Gather background information, including:

- A. Site plan, to include location of abstraction points, stand pipes, connection to mains, water draw off points, site accommodation.
- B. Operating schedule of site, including number of employees per shift.
- C. Copies of proposed billing rates for water for the expected construction period e.g. metered rate for mains water connections, fixed charges for stand pipes, any abstraction chargers, and charges for tankered water.
- D. Water-using equipment on site list, and manufacturer's recommended flow requirements.

4. Ensure contact details for site staff available, including but not limited to:

- A. Site manager
- B. Environment manager (if appropriate).

5. Prepare site diary:

- A. Maintain a site diary to record specific water using processes on site during the audit period. Particular attention should be paid to changes in water use practices during construction.
- B. Identify appropriate site staff to ensure the site diary accurately reflects what is happening on the site.

Water use data

Quantitative information relating to the volume of water used is key to a successful and useful audit process. During the definition and installation of the monitoring equipment, Form B should be completed to record how water use data is monitored.

- 1. Based on the purpose of the water audit, define the required monitoring points for the construction site. These might include:**
 - A. Each abstraction point, stand pipe and connection to mains;
 - B. Critical sections of the site;
 - C. A point for parts of the site at different phases of work;
 - D. Points prior to specific draw off points for a particular purpose e.g. site accommodation, or cement batching; or
 - E. Points downstream of specific draw off points if these exist so that consumption for a specific purpose can be calculated.

- 2. Decide on the appropriate monitoring equipment to install, this could be:**
 - A. A water meter of appropriate size for the location (to be manually read at a set frequency);
 - B. A water meter of appropriate size for the location with logging equipment (to be manually downloaded at a set frequency); or
 - C. A water meter of appropriate size for the location with logging equipment and telemetry to allow remote download of information.

- 3. Install monitoring equipment. Take initial meter readings.**

Conducting the audit

If the purpose of the water audit is to determine the impact of using a certain process/technology or implementing a particular behaviour change, the water audit should monitor water use before and after the change in practice. This will allow the impact of the change in practice to be most accurately defined as most other external factors will remain the same. The site diary should be used to identify any external factors that will affect the results

- 1. Conduct a walk-through survey of the site:**
 - A. Identify and record water use on the construction site.
 - B. Ensure correct monitoring of water use is in place.
 - C. Where applicable, witness use of specific water using equipment or processes and record actual water use or behavioural notes.
 - D. Make a photographic record of water use on site, in particular photos need to be taken of good or poor practice in terms of water efficiency.

- 2. Collect data on water use from the monitoring system.**

3. Form C should be used to record audit information and the data collected at a suitable frequency and duration:

- A. The appropriate time scale and frequency of meter reads will depend on site type, timetable and monitoring equipment installed. It is suggested that as a minimum monthly readings should be taken.
- B. The duration of the water audit will depend on the purpose of the audit (i.e. for the duration of construction, the duration of a construction phase(s) or the duration that a particular technology or process is used).
- C. To analysis and compare water audit results it is vital to capture information which can form data sets for normalization. The primary data set for this will be hours worked, this can usually be obtained from site safety records.

Analysis of audit information

- 1. Report the results of the water audit using Form B, Form C (with Form D) and the information gathered for Form A.**
- 2. Prepare an audit report either upon completion of site work or on an annual basis. If appropriate a preliminary report can be prepared and circulated to staff to highlight water use and identify potential benefits.**

FORM A - Preparation checklist

The purpose of this checklist is to ensure that all relevant and necessary information is gathered for the water audit.

Preparation

- Purpose of water audit defined.
- Site identified to carry out water audit.
- Site type and phase of construction considered.
- Contact details for appropriate site staff.
- Site plan, to include location of abstraction points, stand pipes, connection to mains, water draw off points, site accommodation.
- Operating schedule of site, including number of employees per shift.
- Proposed billing rates for water for the expected construction period e.g. metered rate for mains water connections, fixed charges for stand pipes, any abstraction chargers, and charges for tankered water.
- List of water-using equipment on site and manufacturer's recommended flow requirements.

Water use data

- List of meters installed on site.
- Records of tankers brought to site.
- List of water-using equipment for flow rate records.

Site water use diary

- Site diary prepared and assigned to appropriate person.

Water saving equipment and practises

- List of water-saving features and behaviours being implemented.
- Cost of water-saving feature and cost of 'standard' feature identified (where applicable).

FORM C – Data collection

<i>Date of audit start:</i>			<i>Date of audit end:</i>		
<i>Audited by:</i>					
<i>Site name:</i>					
<i>Location (Region):</i>					
<i>Purpose of audit:</i>					
<i>Phase of construction at audit start:</i>					
<i>Phase of construction at audit end:</i>					
<i>Value of site (£million contractors output):</i>					
<i>Footprint area of site:</i>				Ha	m ²
<i>Length of scheme, where applicable (km):</i>					
<i>Hours worked (by site staff):</i>					
<i>Max number of people on site at any one time:</i>					
Classification	Civil engineering		Industrial buildings		
	Commercial offices		Leisure		
	Commercial retail		Mixed use developments		
	Commercial other		Public buildings		
	Education		Residential		
	Healthcare				
Project Use Class:	(Please select using Table 1 in Form D)				
Project Type:	Civil engineering		New build		
	Demolition		New build and refurbishment		
	Demolition and new build		Refurbishment		
	Fit out		Remediation		
Construction Type:	Civil engineering		Load bearing masonry		
	Composite		Steel frame		
	Concrete frame		Timber frame		
	Light gauge steel				
Client Type:	(Please select using Table 2 in Form D)				

FORM D – Information for Form C

This form should be used to select the correct information to be entered on Form C.

Table I - Project Use Class based on Classification

Civil Engineering	Commercial Offices	Commercial Other	Commercial Retail	Education	Healthcare
Bridge	Institutional	Film/TV studio	Food Store	Primary School/ Nursery	Hospital
Tunnel	Suites	Telecommunications	Shop	High School	Nursing Home
Road	Call centre	Newspaper HQ	Retail Warehouse	University/College	Health Centre
Railway	Other	Postal Service	Shopping Centre	Student Accommodation	Other
General Infrastructure		Banks/Building society	Supermarket	Sports facilities	
Earthworks		Institutional	Department Store		
Costal and River works			Retail – other		
Water Utilities					
Gas Utilities					
Electricity Utilities					
Sewage Utilities					
Nuclear Utilities					
Surface car park					
Multi Storey car park					
Filling Station/ Garage					
Railway Station					
Airport					
Airport Runway					
Transport other					

Table I - Project Use Class based on Classification (continued)

Industrial Buildings	Leisure	Mixed Use Developments	Public Buildings	Residential
Heavy Industry	Cinema	Houses/shops	Fire/Police Station	Flats/Apartments
Light Industry	Holiday Camp/Village	Offices/Shops	Government	Houses
Food Industry	Indoor Leisure	Houses/Offices/ Shops	Embassies	Care Home
Scientific labs/research	Sports Hall/Centre	Other	Prison Service	Hostel
Distribution/ Warehousing	Outdoor sports/ Stadium		Residential	Military Accommodation
Chemical/Pharmaceutical	Park/Playground		Museums/Galleries	Houses/Flats/Apartments
Hi-tech manufacture	Pub/ Club		Religious Centre	
Farm buildings	Restaurant/Food		Other	
Other	Theatre			
	Commercial Exhibition			
	Mixed			
	Visitor Centre			
	Swimming Pool			
	Hotel			
	Other			

Table 2: Client Types

Developer
Educational Trust
Foreign Government
General Trust
Government Agency
Health Service Trust
Housing Association
Insurance Company
Investment/Finance Company
Local Government
Main Contractor
Manufacturing
PFI/DBFO Concessionaire
Private Individual
Retail Company
Single Project Developer
Single Project Trading Company
Trading Company
University
Utility Company
Other Specific Trusts

Table 3: Contractual Agreement

Alliance
Consortium
Individual Company
Joint Venture
Strategic Partnership
Other

Annexe E:

Matrix of sites for water audits

The following table has been developed to identify the possible combinations of site type and construction phase which should be considered when conducting a water audit.

It is recommended that each combination of site type and construction phase should be subject to a minimum of three water audits to allow any trends to be identified. Due to the expected variation in water use for each process across different sites, an increased sample size will result in significantly more robust results.

		Site Type											
		New domestic	New infrastructure (Road)	New infrastructure (Rail)	New infrastructure (Flood Defence)	New infrastructure (Structure)	New retail	New office	New education	New health	New other non-domestic	Refurbishment & maintenance	
Construction Phase	Deconstruction												
	Off site manufacturing and assembly												
	Enabling works and remediation												
	Site accommodation												
	Corporate offices												
	Construction on site												
	Fit out and finishing												
	Landscaping												
	Commissioning												

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